REMARKS/ARGUMENTS

Claims 56-101 remain pending in the instant application. Favorable reconsideration is kindly requested.

The Office action states that claims 60-62, 63-64, and 84-95 are withdrawn as being drawn to a nonelected species or an invention non-elected without traverse.

Applicant withdraws Claim 57 and Claim 80.

Rejection Under 35 U.S.C. § 112

Claims 56-59, 65-83 and 96-102~~0~~ are rejected under 35 U.S.C. § 112, second ~~first~~ paragraph as being indefinite for failing to ~~e~~particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The office action avers the phrase "systematically varied" to include non-uniform fully random variation.

The test for written description is not *ipsis verbis* test. *Martin v. Johnson*, 434 F.2d 746 (CCPA 1972); MPEP §2163 (II)(A)(3)(a). The specification need only "describe the claimed invention so that one skilled in the art can recognize what is claimed." *University of Rochester v. G.D. Searle & Co., Inc.*, 358 F.3d 916 (Fed. Cir. 2004). For example, as referenced above, the disclosure at Figures 16, 17 and 20, for example, and their accompanying description, provide adequate support for one of ordinary skill in the art to recognize a systematic variation in orifice size or spacing.

However, and without acquiescing in the proprietary of the rejection, independent claim 56 is amended above to strike the clauses that are the basis for the rejection.

The office action notes absence of "positive claims to physical values or a slope or gradient or formula". Applicant amends claims to include "convex" and "concave" distributions to provide a clearer description of the systematic variation in magnitude, gradient, and curvature, and normalized comparisons thereof.

Therefore, Applicant respectfully submits that this aspect of the rejection has been obviated. Therefore, Applicant respectfully submits that the rejection has been obviated, and kindly solicits favorable reconsideration and withdrawal.

Rejection Under 35 U.S.C. § 102

OA11 Rejection under 35 U.S.C. 102(b) as being anticipated by Woilles et al. US 4,859,071.

Claims 56-59, 70-76, 78-82 and 96-102 are rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 4,859,071 to Woilles, et al. ("Woilles"). Applicant respectfully traverses the rejection, for at least the following reasons.

As amended above, claim 56 recites, *inter alia*,

" the second fluid having a convex transverse second flow distribution; . . ."

"wherein one of the orifice spacing distribution and orifice size distribution is configured to give a convex transverse net orifice area distribution in the duct's central region;
the transverse net orifice area distribution being the locally averaged spatial density of net orifice area per duct cross-sectional area, when projected onto a plane transverse to the duct."

"Convex" defines a curvature in the "transverse second flow distribution" as exemplified by the curve marked "2ND FLUID FLOW" in Fig. 18. "Convex" is defined in the McGraw-Hill Dictionary of Scientific and Technical Terms 6th ed., as:

"Having a curved form which bulges outward, resembling the exterior of a sphere or cylinder of a section o these bodies."

Similarly, "concave" is defined as:

"Having a curved form which bulges inward resembling the interior of a sphere or cylinder or a section of these bodies."

Mathematically convex (or concave) curvature in a transverse direction includes:
1)a peak (or valley) in a central region having a magnitude greater than (or less than) in other regions,
2)a change in slope from a positive (negative) slope on one side up to that peak (valley) to a negative (positive) slope after that peak (valley); and
3)a negative (positive) second derivative in that region.

Establishing convex or concave curvature or a negative or positive second derivative requires at least three values at three spatially differentiated locations in the specified transverse direction.

This amendment is fully supported in the original specification as filed, for example, see Figures 7-11, 17, 21 or 23, and their associated descriptions. No new matter has been added.

In contrast to amended claim 56, each of the orifice distributions according to Woilles is characterized by opposed jets positioned to mix upper and lower non miscible fluid phases. Woilles makes no reference to convex or concave flow or orifice configurations.

For example, with reference to Figure 2, Woilles shows a central region inside injection ring 12 with three pairs of opposed nozzles 24 pointing horizontally. Woilles further shows an outer region between "injection ring" 12 and "injection ring" 10 showing pairs of opposed nozzles 20 and 22. Orifices 20 and 22 appear uniformly distributed around the circumference of their respective axisymmetric fluid contactors 10, 12.

Structurally Woilles is incapable of providing a "convex transverse distribution" as it provides insufficient orifices in the central region transverse to the flow to even calculate a second derivative as essential to showing a convex curvature for "to give a convex transverse net orifice area distribution in the duct's central region" of amended Claim 56.

Claims to the orifice orientation have been moved to dependent Claims 76 and 101:

"wherein orifices on the elongated fluid contactor are configured with a plurality of attack angles between orifice axis and the duct axis, and orifices on a nearby elongated contactor are configured with a plurality of attack angles."

"wherein the distribution of the absolute value of orifice angle of attack to the second fluid flow path is non-uniform, along the elongated fluid contactor axis or circumferentially around the elongated fluid contactor, excluding a first and second orthogonal directions transverse to the second fluid flow path."

Woilles orients orifices 20 and 22 opposed to each other. Consequently, orifices 20 have a common attack angle of orifice axis to the second fluid flow or axis of the duct 2. Orifices 22 similarly have a common angle of attack to the duct axis. Woilles orients orifices 24 perpendicular to the flow with an attack angle of 90 degrees. Similarly, orifices 26 upstream manifold 14 are oriented radially inward with an attack angle of 90 degrees.

Therefore, Woilles neither discloses nor suggests a convex configuration of orifices in the central region as recited in independent claim 56. Nor does Woilles teach or provide orifices sufficient for: "a concave transverse distribution in a non-central duct region;" as in claim 99.

Nor does Woilles configure orifices with attack angles as disclosed in claims 76 and 101. Applicant respectfully submits that claims 56, 76, 99 and 101 are patentably distinguished over Woilles, and kindly requests favorable reconsideration and withdrawal.

OA11 Rejection under 35 U.S.C. 102(b) as being anticipated by Stirling 5004484.

As above, Stirling provides rings of orifices 36 oriented inward around duct. Stirling teaches using rings of orifices jetting inward from a duct wall, including orifices "both angled and skewed to

the perpendicular of the axis." Stirling does not provide radially distributed orifices, and is incapable of configuring either convex or concave transverse orifice distributions as in Claim 56 and in claims 99 and 102. Applicant respectfully submits that Stirling does not anticipate the invention as claimed in 56.

Furthermore, Stirling does not appear to teach or show a non-uniform axial distribution of fluid delivery through orifices 36, as claimed in Claims 96 and 97.

OA12 Rejection under 35 U.S.C. 102(b) as being anticipated by Davis, Jr et al 4719748.

Davis, Jr. et al. 4719748 teaches impingement cooling of a transition duct by delivering jets to impinge on a wall across a shallow delivery duct. Though varying orifices along the surfaces of the delivery duct, Davis does not appear to teach providing a convex distribution of orifice spacing nor of orifice size across the duct.

The Federal Circuit has recently reiterated the strict novelty requirement for anticipation, holding "Because the hallmark of anticipation is prior invention, the prior art reference—in order to anticipate under 35 U.S.C. § 102—must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements 'arranged as in the claim.' " *Net MoneyIN, Inc., v. Verisign, Inc.*, 545 F.3d 1359, 88 U.S.P.Q.2d 1751 (Fed. Cir., 2008)

Therefore, Applicant respectfully submits that claim 56 is patentably distinguished over Woilles, Stirling, and Davis Jr. Claims 58-59, 70-76, 78-82 and 96-103 each depend, either directly or indirectly, from independent claim 56, and incorporate the features of claim 56 by reference. These dependent claims are each separately patentable, but in the interest of brevity they are offered as patentable for at least the same reasons as their underlying independent base claim. Therefore, Applicant respectfully submits that the rejection has been obviated, and kindly requests favorable reconsideration and withdrawal.

Rejection Under 35 U.S.C. § 103

Claims 68-69, 77 and 83 are rejected under 35 U.S.C. § 103(a) as obvious over Woilles taken alone. Claims 65-67 are rejected under 35 U.S.C. § 103(a) as obvious over Woilles in view of U.S. Patent Application Publication No. 2003/0086333 by Tsouris, et al. ("Tsouris") and U.S. Patent No. 3,570,513 to Paine ("Paine"). Applicant respectfully traverses the rejections, for at least the following reasons.

The office action asserts Claim 83 is obvious as thinner walls have lower costs. However this is opposite the evidence of industry pricing in these small sizes. For example, Microgroup quotes the following prices for their small hypodermic needles:

	OD in	ID in	Price	Price/area	Steel
304 Hypo 31 Gauge	0.010	0.005	$14.91	$475	916
304 Hypo 32 Gauge	0.009	0.004	$16.53	$585	1708
304 Hypo 33 Gauge	0.008	0.004	$17.51	$697	1260
304 Hypo 34 Gauge	0.007	0.002	$21.82	$992	3218
Regular wall, full hard temper					

Note that the price per surface area more than doubles as the tubing diameter declines even from 0.010" OD to 0.007" OD. In addition, the methods claimed require further processing which further increases the costs for thinner orifice walls. Applicant submits that those skilled in the art would expect prices to increase not decrease and thus the claimed features are not obvious compared to macro methods.

Neither Woilles, Stirling, Davis Jr., Tsouris nor Paine even recognize that the second flow has a convex distribution, let alone provide any teaching to provide a convex distribution or either orifice size, orifice spacing, or orifice area. Furthermore, none of them structurally provide sufficient orifices distributed across the flow to configure a convex distribution in the central region.

Paine 3570513 teaches diverting a jet. It does not teach how to reduce a jet by the application of high voltage, as claimed in 66. Similarly, Paine teaches switching a flow and clamping it between discrete channels, not of controlling to voltage to oscillate the fluid jet.

Tsouris teaches methods for mixing within microchannels, not for modifying macroflows of liquid jets in macro ducts where numerous orifices deliver liquid jets of first fluid with a convex transverse orifice area distribution to mix with the second fluid in the duct. Tsouris only shows two entering flows in a T configuration, without any distribution of orifices across a duct, let alone teaching use of sufficient orifices to configure a convex distribution within a duct central portion. Furthermore, Tsouris teaches modifying liquids with provision for removal of gas formed by electrolysis. Tsouris does not teach delivering liquids via orifices into gases. Nor does Tsouris teach reducing the size of a liquid jet leaving the orifice by application of a high voltage electric field, nor of controlling the voltage to avoid an arc.

Furthermore, claims 65-69, 77 and 83 each depend, either directly or indirectly, from independent claim 56, and incorporate the features of claim 56 by reference. Even presuming, *arguendo*, that the proposed modification to Woilles were within the level of ordinary skill in the art proposed in the Office Action, and that Tsouris and/or Paine teach all that is attributed to them, and

further presuming that there is some objective apparent reason to modify Woilles as proposed in the Office Action, Applicant respectfully submits that the claims are nonetheless patentably distinguished. Neither the proposed modification of Woilles in view of no reference, nor the proposed combination with Tsouris and/or Paine, ameliorates the underlying deficiency of Woilles with respect to claim 56 as noted above.

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Therefore, while these dependent claims are each separately patentable, in the interest of brevity they are offered as patentable for at least the same reasons as their underlying independent base claim 56. Therefore, Applicant respectfully submits that the rejection has been obviated, and kindly requests favorable reconsideration and withdrawal.

Conclusion

In light of the foregoing, Applicant respectfully submits that all claims are patentable, and kindly solicits an early and favorable Notice of Allowability.

05/24/10

Respectfully submitted,

David L. Hagen